SDS Hackathon

Dataset: 58

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Section: F

Descriptive Statistics

In [110]:

```python
import pandas as pd
import seaborn as sb
import numpy as np
import matplotlib.pyplot as plt

data = pd.read_csv("58.csv")
data.head()
```

Out[110]:

	gender	race	parental level of education	lunch	test preparation course	math score	reading score	writing score
0	female	group B	bachelor's degree	standard	none	87.0	99.0	88.0
1	female	group A	some high school	standard	completed	21.0	117.0	102.0
2	male	group C	some high school	standard	none	105.0	115.0	107.0
3	male	group A	some college	standard	none	62.0	84.0	58.0
4	female	group D	some college	standard	none	91.0	105.0	89.0

```
In [111]: srs = data.sample(n=100)
```

Out[111]:

	gender	race	parental level of education	lunch	test preparation course	math score	reading score	writing score
261	male	group D	some high school	standard	none	94.0	106.0	92.0
944	female	group D	some college	standard	none	73.0	95.0	75.0
887	male	group C	master's degree	free/reduced	none	69.0	99.0	73.0
783	male	group B	some high school	standard	none	67.0	86.0	76.0
602	female	group D	some high school	standard	none	91.0	20.0	94.0
...	...	...	...	...	...	...	...	...
892	male	group D	master's degree	standard	completed	65.0	94.0	87.0
235	female	group E	some high school	standard	none	95.0	102.0	91.0
271	female	group A	some high school	standard	none	73.0	76.0	56.0
83	male	group C	associate's degree	free/reduced	completed	87.0	91.0	77.0
319	female	group D	some high school	standard	none	71.0	92.0	77.0

100 rows × 8 columns

```
In [112]: def systematic_sampling(df,step):
              indexes = np.arange(0,len(df),step = step)
              systematic_sample = df.iloc[indexes]
              return systematic_sample

          sys_sample = systematic_sampling(data,50)
```

Out[112]:

	gender	race	parental level of education	lunch	test preparation course	math score	reading score	writing score
0	female	group B	bachelor's degree	standard	none	87.0	99.0	88.0
50	female	group D	some high school	standard	none	68.0	86.0	62.0
100	female	group D	associate's degree	standard	none	81.0	94.0	81.0
150	female	group B	master's degree	standard	none	77.0	94.0	106.0
200	female	group C	master's degree	free/reduced	none	82.0	30.0	100.0
250	female	group D	associate's degree	standard	none	62.0	76.0	63.0
300	male	group A	some high school	standard	none	96.0	105.0	95.0
350	female	group D	some high school	free/reduced	completed	110.0	92.0	83.0
400	female	group D	some high school	standard	none	74.0	81.0	81.0
450	female	group A	some high school	free/reduced	completed	79.0	112.0	99.0
500	female	group D	associate's degree	free/reduced	completed	89.0	21.0	96.0
550	male	group D	some high school	standard	completed	94.0	103.0	79.0
600	male	group A	associate's degree	standard	none	69.0	39.0	77.0
650	female	group A	some high school	free/reduced	none	66.0	83.0	67.0
700	female	group D	some high school	standard	completed	94.0	108.0	96.0
750	male	group A	some high school	standard	completed	86.0	96.0	82.0
800	male	group A	associate's degree	standard	none	82.0	100.0	82.0
850	male	group A	some high school	standard	completed	86.0	94.0	81.0
900	female	group A	master's degree	standard	none	100.0	111.0	103.0
950	female	group A	associate's degree	standard	none	109.0	100.0	85.0

In [113]:

```
dataTypeSeries = data.dtypes
print('The data type of each column of data is:')
print(dataTypeSeries)
```

```
The data type of each column of data is:
gender                          object
race                            object
parental level of education     object
lunch                           object
test preparation course         object
math score                     float64
reading score                  float64
writing score                  float64
dtype: object
```

In [114]:

```
print("Reading Score:            ", int(data["reading score"].mean()))
print("Math Score:               ", int(data["math score"].mean()))
print("Test Preparation Course:  ", data['test preparation course'].mode())
```

```
Reading Score:             94
Math Score:                80
Test Preparation Course:   0    none
dtype: object
```

Here, we see that the mean value of math score is 94, and the modal value of test preparation course is 'none'.

In [115]:
```
data.describe()
```

Out[115]:

	math score	reading score	writing score
count	997.000000	997.000000	996.000000
mean	80.225677	94.132397	80.983936
std	16.967670	17.083557	16.762237
min	20.000000	20.000000	24.000000
25%	70.000000	85.000000	71.000000
50%	81.000000	97.000000	82.000000
75%	92.000000	106.000000	92.250000
max	116.000000	120.000000	119.000000

We can notice a disparity in the number of records for reading score and the other scores. Let us investigate this further by finding total number of records.

In [116]:
```
print("The total number of records is\n",data.count())
```

```
The total number of records is
 gender                          1000
race                           1000
parental level of education     996
lunch                          1000
test preparation course        1000
math score                      997
reading score                   997
writing score                   996
dtype: int64
```

Here we see there is a disparity in the number of rows for each column. This indicates that there is missing data for which we will need to do data cleaning in order to make sure the data can be worked with.

As we are working to find the relation between test preparation score and math score, we cannot have

As the number of records with missing values is very small compared to the total size of our data set, we can simply drop records with missing values

Data Cleaning

As we have a small number of records with missing values, we are opting to drop these records and then proceed with further analysis

In [117]:
```
data.dropna(inplace=True)
print("After data cleaning:\n")
```

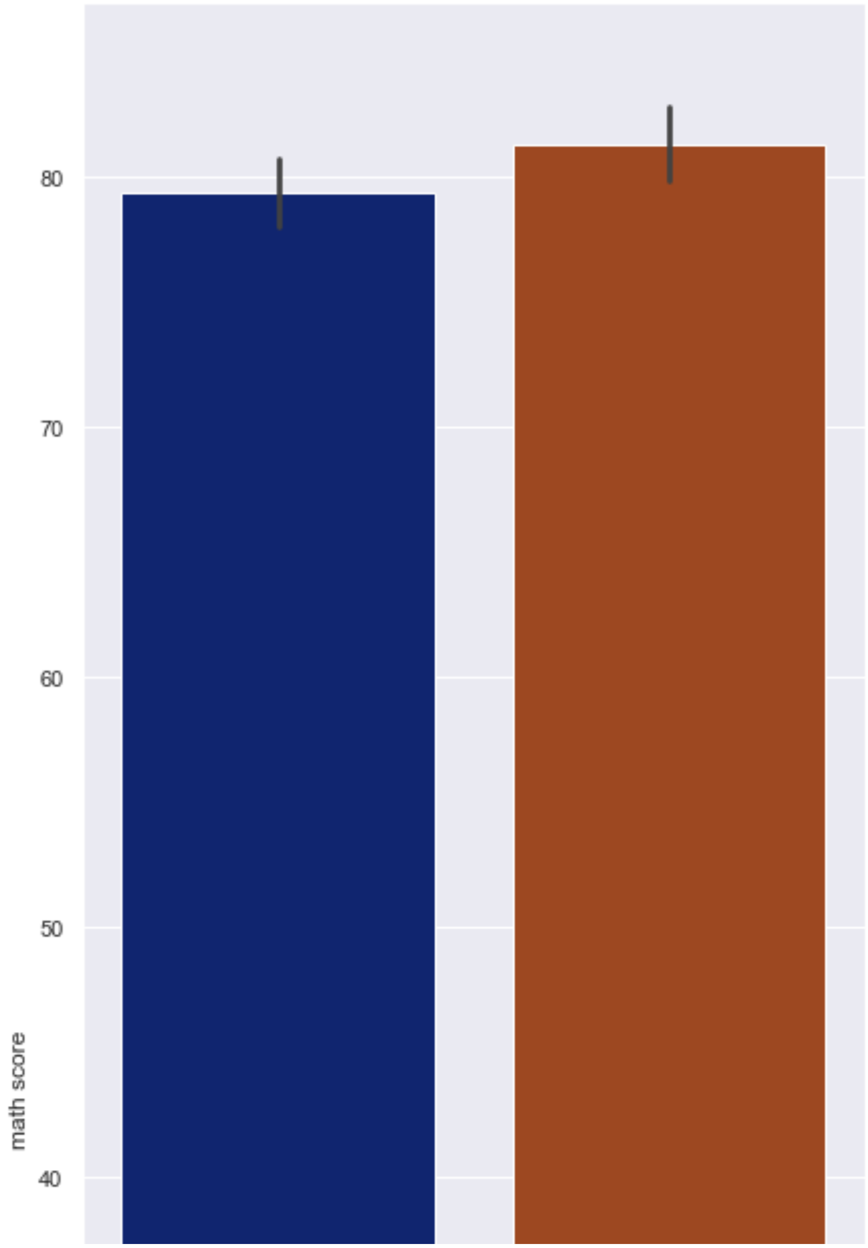
```
After data cleaning:
```

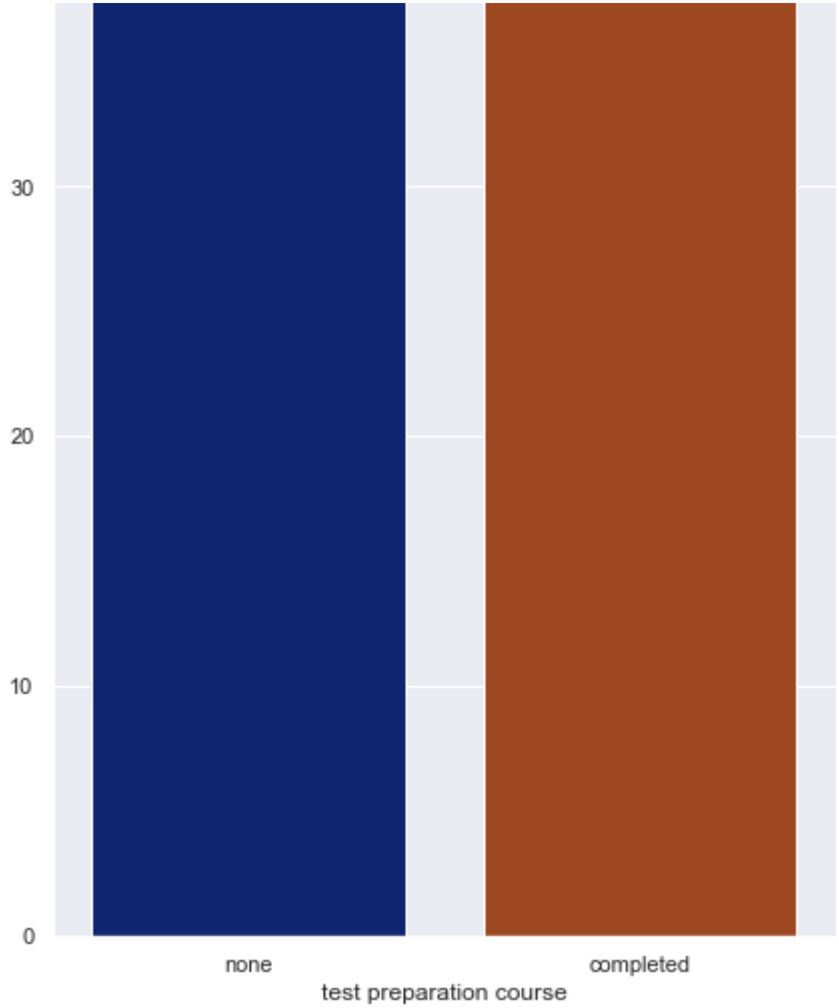
Out[117]:
```
gender                         991
race                           991
parental level of education    991
lunch                          991
test preparation course        991
math score                     991
reading score                  991
writing score                  991
dtype: int64
```

The data has been successfully cleaned and is now suitable for resgression and other forms of analysis

In [118]:
```
sb.set_palette('dark')
```

Out[118]:
```
<AxesSubplot:xlabel='test preparation course', ylabel='math score'>
```

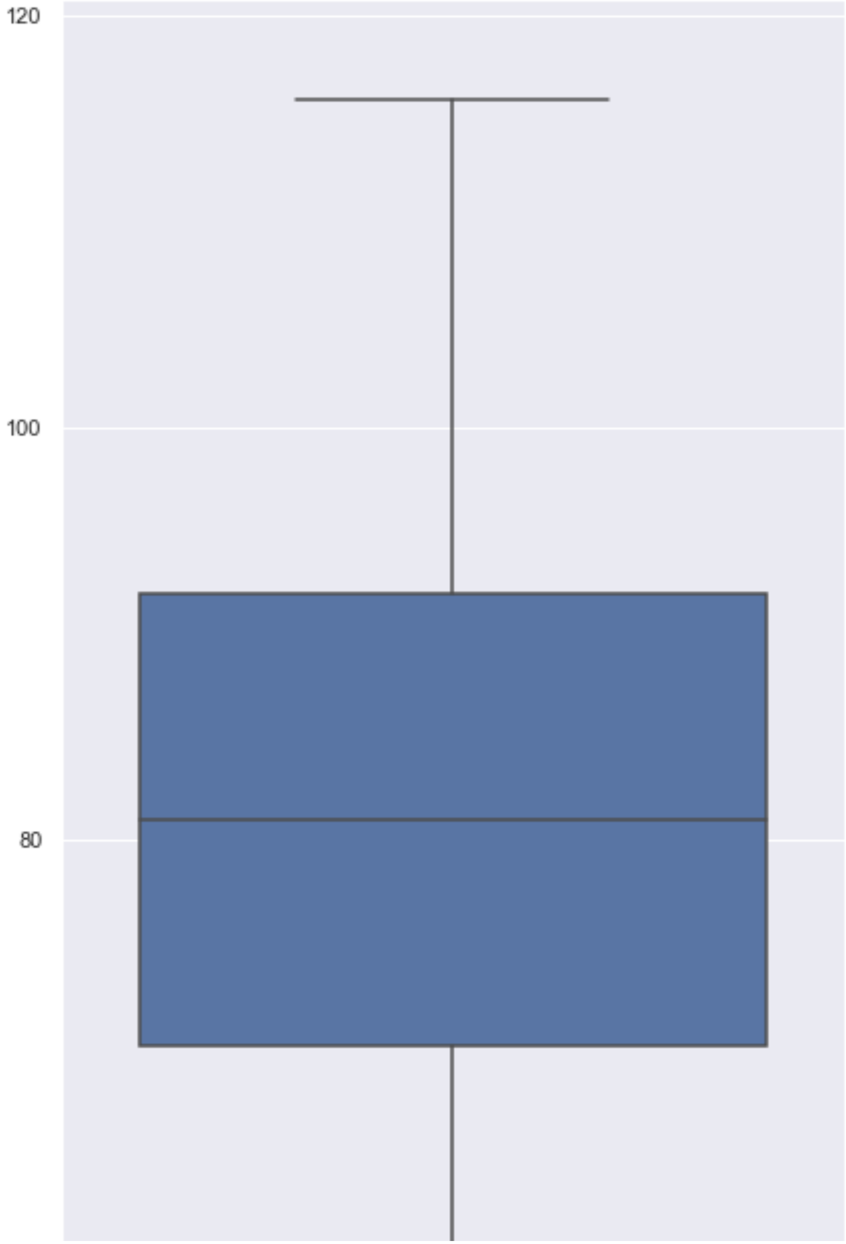


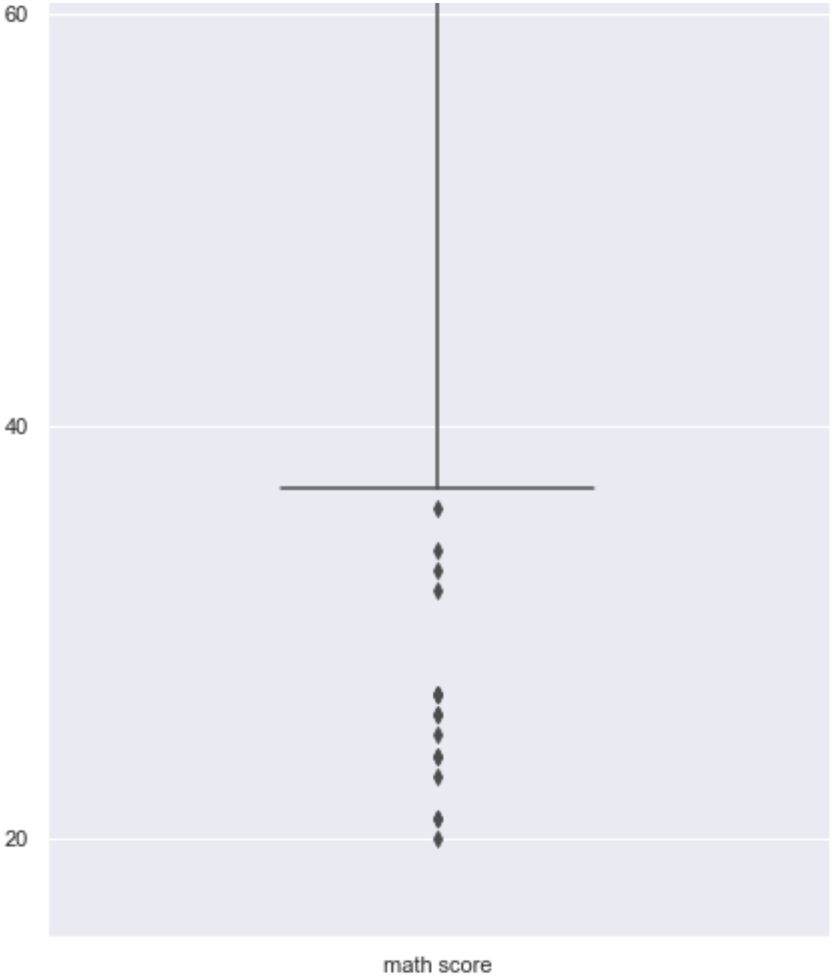


nethod of visualisation, so we will test alternate

In [119]:
```
sb.set(rc = {'figure.figsize':(7,20)})
[illegible]
```

Out[119]:
```
<AxesSubplot:>
```

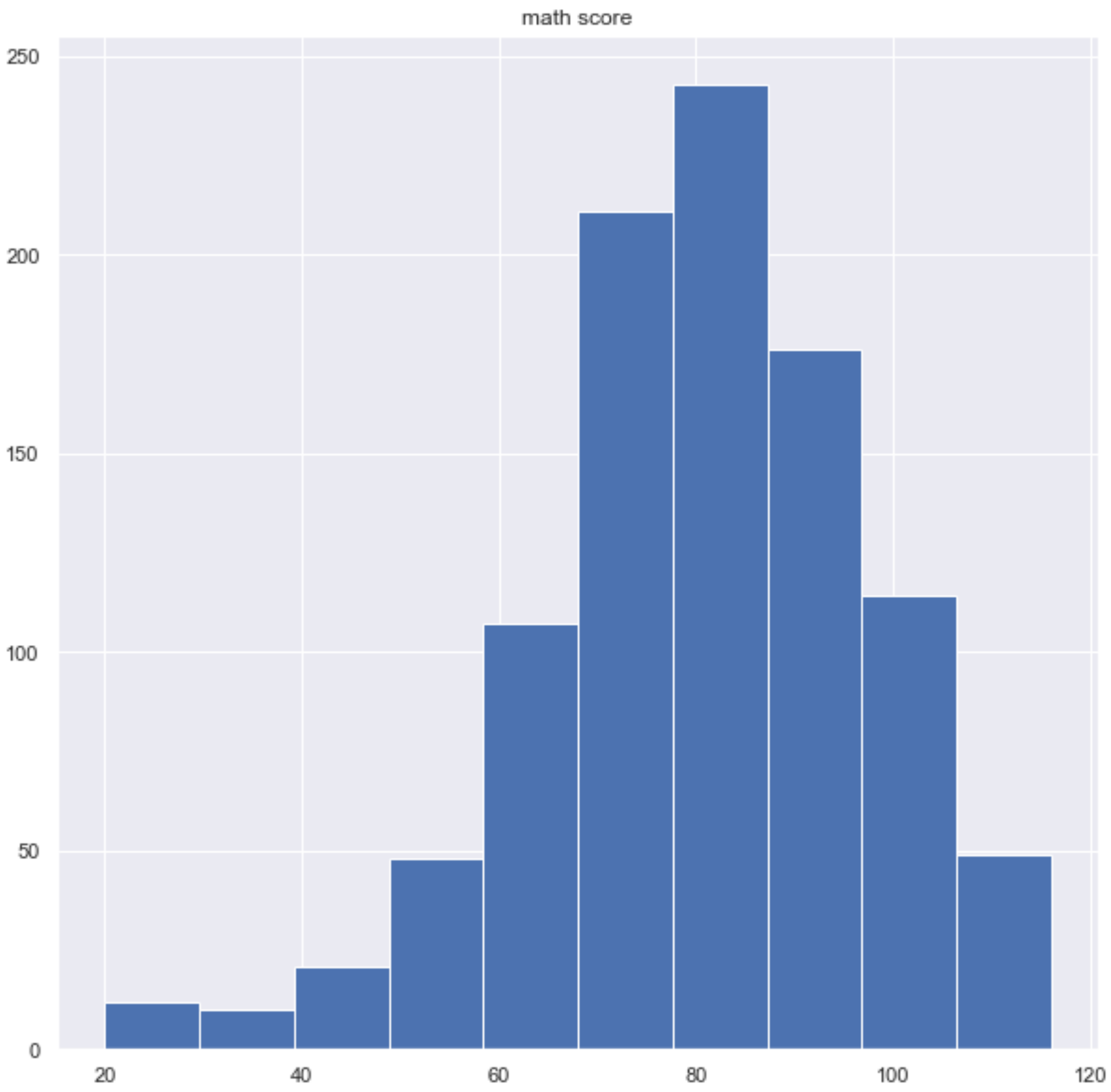




of math score that shows the distribution of values.
en math score and test preparation course

```
In [120]: data.hist(column='math score', figsize=(10,10))
```

```
Out[120]: array([[<AxesSubplot:title={'center':'math score'}>]], dtype=object)
```



It is evident that we cannot conduct any meaningful analysis of the relation of between test preparation course completion and maths score without replacing the values of test preparation course with dummy values (namely, 0 for none and 1 for completed)

In [121]:

```
data.replace('none',0,inplace=True)
data.replace('completed',1,inplace=True)
dataTypeSeries = data.dtypes
print('The data type of each column of data is:')
print(dataTypeSeries)
```

```
The data type of each column of data is:
gender                          object
race                            object
parental level of education     object
lunch                           object
test preparation course          int64
math score                     float64
reading score                  float64
writing score                  float64
dtype: object
```

We see that it is successfully replaced

In [122]:

```
import math
import scipy
```

Bernoulli Distribution

In [123]:
```
no_prep = data[data['test preparation course'] == 0]
prep = data[data['test preparation course'] != 0]

totalcount = len(data.index)
noprep_people = len(no_prep.index)
prep = totalcount - noprep_people
noprepprob = noprep_people/totalcount
prepprob = prep/totalcount
print("Probability of a person being not prepared:",noprepprob)
```

```
Probability of a person being not prepared: 0.5822401614530777
Probability of person being prepared: 0.4177598385469223
```

We see that the probability of a person not being prepared is higher than being prepared

Now, we must do hypothesis testing

We will take α to be 0.05 and as the sample size is very great, we will be doing z test.

As mentioned in the problem statement we will be comparing performace of people in maths, where a good score is considered to be above mean (80) and a bad score being below mean

In [124]:
```
nop = data[data["test preparation course"]==0]
prep = data[data["test preparation course"]==1]

zval1 = (80 - nop["math score"].mean()) / (nop["math score"].std() )
zprob1=scipy.stats.norm.cdf(zval1)

zval2 = (80 - prep["math score"].mean()) / (prep["math score"].std() )
zprob2=scipy.stats.norm.cdf(zval2)
```

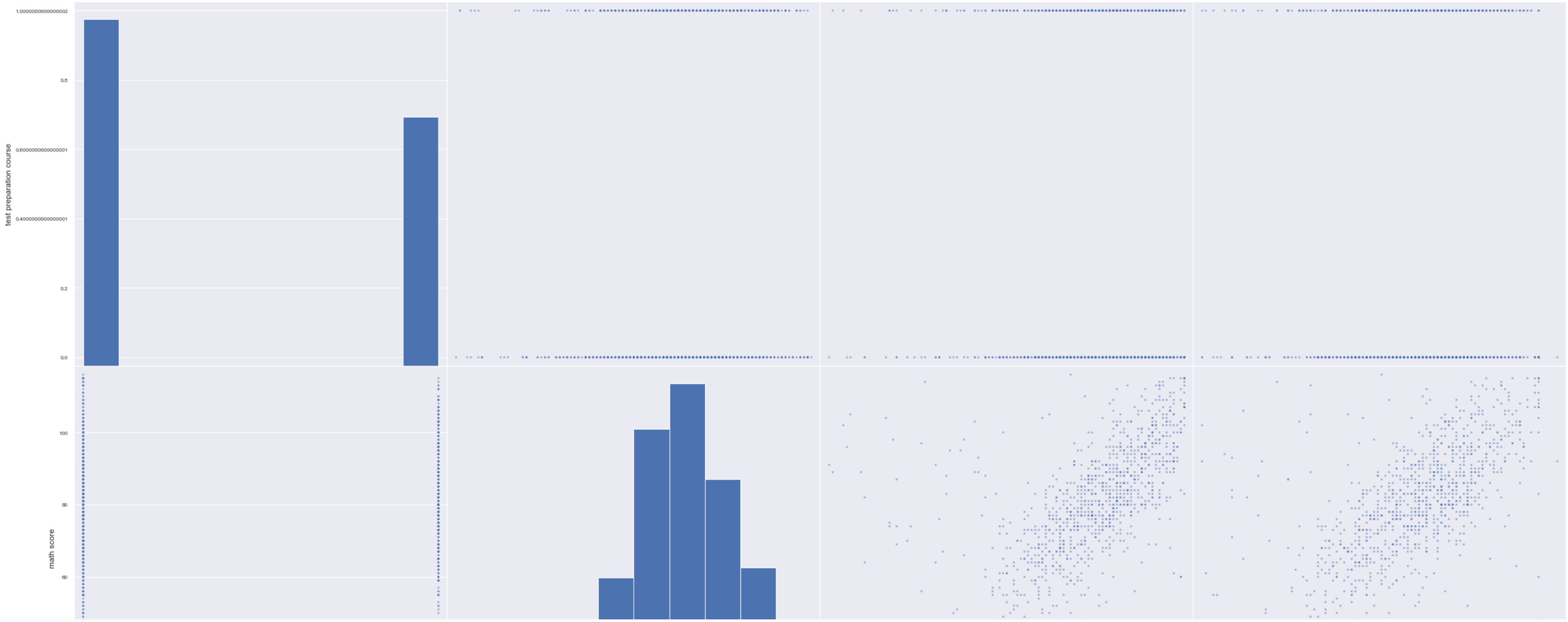
```
The probability of the null hypothesis is  0.046457369343262556
```

As the probability is <0.05, we accept the null hypothesis

Correlation Analysis

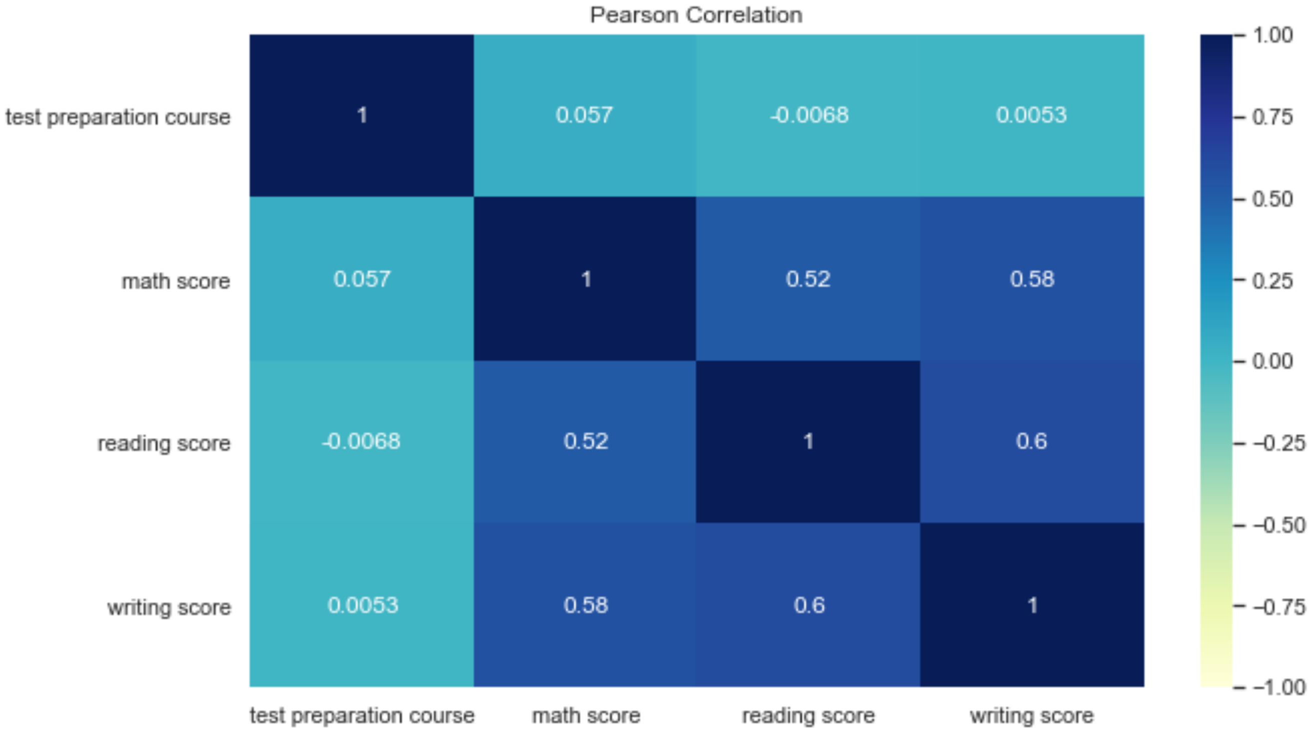
```
In [125]: pd.plotting.scatter_matrix(data,figsize=(40,40))
```

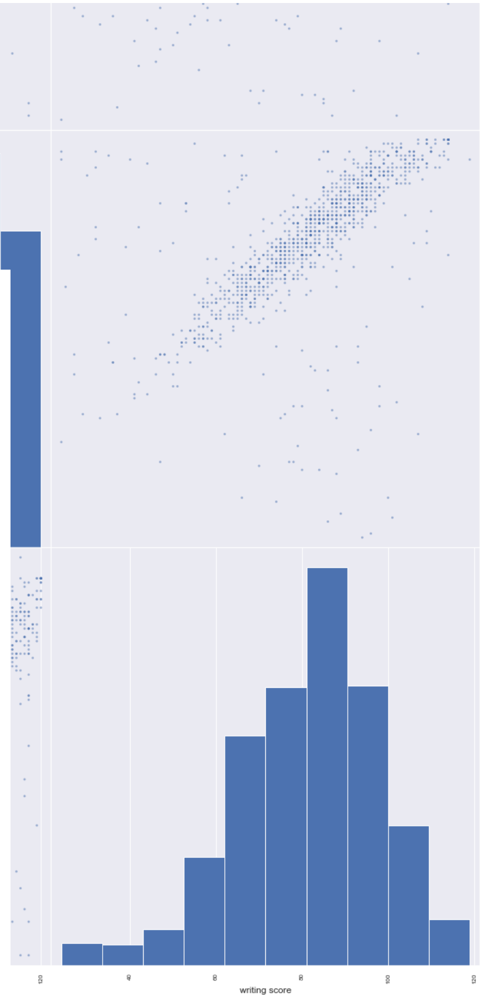
```
Out[125]: array([[<AxesSubplot:xlabel='test preparation course', ylabel='test preparation course'>,
                  <AxesSubplot:xlabel='math score', ylabel='test preparation course'>,
                  <AxesSubplot:xlabel='reading score', ylabel='test preparation course'>,
                  <AxesSubplot:xlabel='writing score', ylabel='test preparation course'>],
                 [<AxesSubplot:xlabel='test preparation course', ylabel='math score'>,
                  <AxesSubplot:xlabel='math score', ylabel='math score'>,
                  <AxesSubplot:xlabel='reading score', ylabel='math score'>,
                  <AxesSubplot:xlabel='writing score', ylabel='math score'>],
                 [<AxesSubplot:xlabel='test preparation course', ylabel='reading score'>,
                  <AxesSubplot:xlabel='math score', ylabel='reading score'>,
                  <AxesSubplot:xlabel='reading score', ylabel='reading score'>,
                  <AxesSubplot:xlabel='writing score', ylabel='reading score'>],
                 [<AxesSubplot:xlabel='test preparation course', ylabel='writing score'>,
                  <AxesSubplot:xlabel='math score', ylabel='writing score'>,
                  <AxesSubplot:xlabel='reading score', ylabel='writing score'>,
                  <AxesSubplot:xlabel='writing score', ylabel='writing score'>]],
                dtype=object)
```



In [126]:
```
data.corr()
r = data.corr()
plt.figure(figsize=(10,6))
heatmap = sb.heatmap(data.corr(), vmin=-1, vmax=1, annot=True, cmap="YlGnBu")
```

Out[126]:
```
Text(0.5, 1.0, 'Pearson Correlation')
```





Regression Analysis

In [127]:
```
from sklearn.linear_model import LinearRegression
from sklearn.model_selection import train_test_split
from sklearn.metrics import mean_absolute_error
```

In [128]:

```python
x, y = data["test preparation course"], data["math score"]
print("Initial shape",x.shape, y.shape)
x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.2, random_state=1)
print("Training Data: ",x_train.shape, y_train.shape)
```

```
Initial shape (991,) (991,)
Training Data:  (792,) (792,)
Testing Data:  (199,) (199,)
```

In [129]:

```python
model = LinearRegression()
```

Out[129]:

```
LinearRegression()
```

Judging our model

In [130]:

```python
r_sq = model.score(np.array(x_train).reshape((-1, 1)), y_train)
print(f"coefficient of determination: {r_sq}")
print(f"intercept: {model.intercept_}")
```

```
coefficient of determination: 0.002611996072485634
intercept: 79.41176470588235
slope: [1.74439145]
```

Performing Testing

In [132]:

```python
yhat = model.predict(np.array(x_test).reshape((-1, 1)))
mae = mean_absolute_error(y_test, yhat)
print('MAE: %.3f' % mae)
mse = mean_squared_error(y_test, yhat)
```

```
MAE: 13.803
MSE: 302.299
```

In [ ]: